

REMARKS

New drawing Figure 7A is added, depicting the embodiment claimed in claims 25-26, and disclosed in the Written Description at p. 5, lines 7-10. An explanatory paragraph is added to the Written Description. No new matter is added.

The Abstract of the specification is amended herein to omit the term "comprising."

Claims 2, 19 and 27 are amended herein to incorporate the Examiner's suggested language or otherwise address the Examiner's concerns.

Claims 6-25 and 27-32 are amended herein to unambiguously specify that it is multipath interference estimates and scalars, generated by multipath interference estimators, that are subtracted from the correlated signals of interest generated by primary RAKE receiver fingers. No new matter is added.

The Examiner rejected claims 10, 12 and 13 under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. The Examiner stated that the Written Description lacks support for the terms "updating" and "adjusting," disclosing only "selecting" values for the scalars. This is a distinction without a difference. The Written Description states, at p. 20, lines 8-17:

One technique for accomplishing the above goal [avoiding introducing inter-symbol interference] is to select the α 's based on maximizing the overall signal to noise plus interference ratio (SNIR) . . . A simpler technique for accomplishing this is to set each $\alpha_{f,l}$ (the scaling applied to $I_{f,l}$) as a ratio of . . . Thus, $\alpha_{f,l}$, which is the scaling factor to be applied to $I_{f,l}$, may be determined as,

$$\alpha_{f,l} = \frac{P_x}{P_x + P_y}$$

The verb "to select" means simply "to choose (something), or to make a choice." (Cambridge Dictionary of American English, see <http://www.dictionary.cambridge.org>). Those of skill in the art fully understand that "selecting" (*i.e.*, "choosing") a value for a variable is the same as "updating" or "adjusting" the variable to assume the new value. In some contexts, "selecting"

may imply selection from among a fixed set; however, nothing in Applicant's Written Description supports such an interpretation. Nowhere does the Written Description mention or suggest that the relevant scalars are chosen from any collection of predetermined values. In fact, quite the opposite – the Written Description provides a mathematical formula for calculating values of α along a continuum constrained only by the (observed) values of P_x and P_y . In such a context, “selecting” a new value for α based on new values of P_x and P_y is identical to “updating” or “adjusting” the value of α based on new values of P_x and P_y , and is unquestionably sufficient to enable one of ordinary skill in the art to make and use Applicant's invention.

To obviate the rejection and in a good faith effort to move the application to allowance, claims 10 and 12 are amended herein to recite “setting” the values of interference estimate scalars, rather than “updating” or “adjusting” them. Support for this term is found in the Written Description at p. 20, line 12 (quoted above); no new matter is added. Applicant notes, however, that these amendments do not narrow the scope of claims 10 or 12 in the slightest; they merely substitute one verb for two verbs, all of which have identical meaning to those of skill in the art in the context of the disclosure.

The Examiner rejected claims 17-19 under 35 U.S.C. § 112, second paragraph, as being indefinite. Claim 16 recites, “A RAKE receiver comprising: at least one primary RAKE finger . . . at least one multipath interference estimator . . . and a subtraction circuit .” Claim 16 reads on any RAKE receiver having exactly one primary RAKE finger and one multipath interference estimator that comply with the other claim limitations. Claim 16 also reads on any RAKE receiver having more than one primary RAKE finger and/or more than one multipath interference estimator that comply with the other claim limitations.

Claim 17, on the other hand, depends from claim 16 and adds the limitations of both a plurality of RAKE fingers and a plurality of multipath interference estimators. Claim 17 adds these limitations by “wherein” clauses, reciting verbatim the limitation of the parent claim being

maintain
narrowed (*i.e.*, the antecedent basis for the narrowed limitation), using the open-ended transitional term “comprises,” and reciting the further limitation. While the phrase “wherein the at least one widget comprises a plurality of widgets” may not receive high marks in an English class, it is logically consistent, not indefinite, and fully complies with the requirements of 35 U.S.C. § 112, second paragraph, and all provisions of Title 37 of the CFR and of the MPEP regarding claim language. In particular, the claims particularly point out and distinctly claim the subject matter which Applicant regards as the invention – to wit, at least one each of a primary RAKE finger and multipath interference estimator in claim 16, and a plurality of each element in claims 17-19 – and would be understood as such by one of ordinary skill in the art. The § 112 rejections are improper.

The Examiner rejected claims 1, 3, 6, 7, 16, 17, 19 and 27 under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 6,233,272 to Yugawa. (“Yugawa”). Yugawa discloses CDMA receiver that eliminates intersymbol interference. That is, the interference in a received signal caused by interference from a different symbol in a different propagation path, wherein the delay exceeds the intersymbol timing. As Yugawa explains at col. 2, lines 10-32, with reference to FIG 2:

[T]he above conventional spread spectrum communication receiver has the following disadvantages, which will be encountered when there is a signal which is propagated through a path having a delay time longer than the symbol interval and which overlaps with a signal of the next symbol propagated through a path having a relatively small delay time.

FIG. 2B shows a path 16 located in the next symbol interval. The path 16 has a delay time longer than the symbol interval. The path 16 shown in FIG. 2B does not overlap with any path located in the next symbol interval. In this case, the spread spectrum communication receiver can demodulate the symbol from the signals propagated through the paths 13, 14 and 15 and the symbol from the signals propagated through paths 17, 18 and 19.

FIG. 2C shows that the path 16 overlaps with the path 18 in the next symbol interval. The conventional receiver does not discriminate the signals respectively propagated through the paths 16 and 18 from each other. Hence, the signal propagated through the path 16 functions as noise when the signal propagated through the path 18 is demodulated in the next symbol interval. This degrades the reception performance of the receiver.

Claim 1 recites generating a multipath interference estimate, and subtracting the multipath interference estimate out of the correlation of a received composite signal with a PN code sequence. As disclosed at p. 4, lines 18-21, "each interference estimator estimates the multipath interference in the signal of interest recovered by its respective primary RAKE finger arising from a remaining one of the multipath propagation paths." The multipath interference estimated is not intersymbol interference, it is interference with one propagation path from another propagation path that degrades recovery of the same symbol. This is clear from the discussion at p. 19, line 20 – p. 20, line 7:

The interference estimation technique employed by the interference estimation RAKE 204, could, absent proper care, result in adding additional interference to the combined output of the primary RAKE 202. This possibility principally arises from the correlation window shifting employed by the individual interference estimators 214. Because the correlation window shifts used in the interference estimators 214 are not necessarily time aligned to symbol boundaries in the received CDMA signal, correlation results include correlations across symbols, which may result in additional interference. Thus, the interference estimation RAKE 204 employs one of several techniques to arrive at a set of scaling factors that ensure the scaled versions of the multipath interference estimates $I_{f,i}$ produced by the interference estimators 214 accomplish the desired function of reducing, or at least not adding interference to the combined output signal from the primary RAKE 202.

Thus, a primary concern of the present invention is the avoidance of introducing intersymbol interference. The reference to intersymbol interference as an undesired additional interference clearly demonstrates that the multipath interference that the present invention reduces is not itself intersymbol interference.

The claims are amended herein to explicitly specify that multipath interference estimates and scalars, generated by multipath interference estimators, are subtracted from a signal of interest derived from correlating a received signal with a PN code. These amendments make manifest that the claims do not recite removing intersymbol interference from a correlated received signal. As Yugawa does not teach or suggest removing multipath interference estimates as claimed, the § 102 rejections are improper.

Yugawa
See col 6 lines 25-28

The Examiner rejected claims 1, 3, 6, 14-17, 19 and 27 under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 6,570,909 to Kansakoski *et al.* ("Kansakoski"). Kansakoski discloses a system for reducing interference from a pilot channel in a received signal. As Kansakoski states at col. 1, lines 7-10, "The present invention relates generally to a method and device for suppressing interference between the pilot channel and other channels in a code-division multiple access (CDMA) mobile telephone system." Kansakoski explains this is further detail at col. 1, lines 50-65:

The present invention relates to a system and method for canceling interference present in a code-division multiple access (CDMA) channel signal received at a CDMA receiver that is caused by multipath components of a transmitted pilot channel signal. The channel signal from which such multipath interference is canceled can be either a traffic (data) channel or the pilot channel itself.

Kansakoski contemplates precisely two interference cancellation possibilities. "In embodiments of the invention in which pilot channel interference is canceled from the traffic channel, the cancellation circuit [operates a certain way]." col. 2, lines 4-6. "In embodiments of the invention in which pilot channel interference is canceled from the pilot channel itself, the cancellation circuit [operates a different way]," col. 2, lines 11-14. No form of interference other than that caused by the pilot channel (on either a data channel or the pilot channel) is disclosed or suggested in Kansakoski. In particular, Kansakoski does not teach or suggest reducing multipath interference caused by multipath propagation of a traffic channel itself. As described in Applicant's Written Description at p. 3, lines 15-19:

A base station transmits a CDMA forward link signal that is received by one or more mobile terminals. Typically, an individual mobile terminal receives the transmitted signal through a number of propagation paths, giving rise to multipath interference in the received CDMA signal. The mobile terminal includes a modified RAKE receiver that reduces multipath interference in the received CDMA signal.

The present invention is not concerned with multipath interference in a traffic channel (i.e., forward link signal) caused by multipath components of a transmitted pilot channel signal.

↑
matters
claims

the task to which Kansakoski is directed in one of its modes. The present invention is not concerned at all with Kansakoski's other mode, reducing interference caused by multipath components of a transmitted pilot channel signal in the pilot signal itself; the present invention does not address interference in the pilot signal at all.

not in the claims

Not surprisingly, being directed to an entirely different problem, the circuits disclosed by Kansakoski do not anticipate Applicant's claims. Claim 1, for example, recites "correlating the received composite signal with the PN code sequence at a time offset corresponding to a delay difference between the first multipath signal and a second multipath signal to generate a multipath interference estimate." The Examiner stated Kansakoski's cancellation correlators 104-112 anticipate this limitation. The correlators 104-112, however, do not correlate the received composite signal with the PN code sequence as recited in claim 1 (having a time offset corresponding to certain delay differences). Rather, the cancellation circuits 104-112 perform the convolution operation indicated in Equation 4, at col. 3, line 4 (col. 5, lines 29-32). Not only does Kansakoski nowhere disclose or suggest that a received signal is correlated with the PN sequence at the claimed time offset, inspection of Eq. 4 reveals any that no "delay difference between the first multipath signal and a second multipath signal" is calculated. Kansakoski thus fails to anticipate claims 1 or 6, both of which recite the delay difference time offset limitation.

Claims 16 and 27 recite a "multipath interference estimator adapted to generate a multipath interference estimate for a corresponding primary RAKE finger caused by a remaining one of the plurality of multipath signals with respect to the selected multipath signal from which the corresponding primary RAKE finger recovers the signal of interest." As discussed above, Kansakoski discloses only reducing interference "that is caused by multipath components of a transmitted pilot channel signal," and hence does not anticipate claims 16 or 27.

claim doesn't differentiate between pilot or data

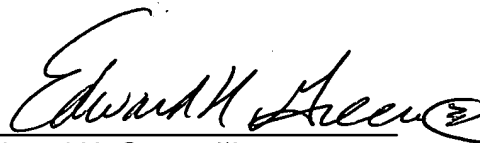
As discussed above, Yugawa fails to teach or suggest the claimed invention. The combination of Yugawa with various references in rejections under 35 U.S.C. § 103 does not

cure this defect. The combinations fail to teach each and every limitation of the present invention, and thus fail to establish a *prima facie* case of obviousness.

All claims as amended herein being patentably novel and nonobvious over the cited art, prompt allowance of all claims is hereby respectfully requested.

Respectfully submitted,

COATS & BENNETT, P.L.L.C.

A handwritten signature in cursive script, reading "Edward H. Green, III", written over a horizontal line.

Edward H. Green, III
Attorney for Applicants
Registration No.: 42,604

Dated: March 31, 2004

P.O. Box 5
Raleigh, NC 27602
Telephone: (919) 854-1844